



US008981261B1

(12) **United States Patent**
Tillotson

(10) **Patent No.:** **US 8,981,261 B1**
(45) **Date of Patent:** **Mar. 17, 2015**

(54) **METHOD AND SYSTEM FOR SHOCKWAVE
ATTENUATION VIA ELECTROMAGNETIC
ARC**

(75) Inventor: **Brian J. Tillotson**, Kent, WA (US)

(73) Assignee: **The Boeing Company**, Chicago, IL
(US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 336 days.

5,400,688 A	3/1995	Eninger et al.
5,739,458 A	4/1998	Girard
6,029,558 A	2/2000	Stevens et al.
6,256,263 B1	7/2001	Stevens
6,266,926 B1	7/2001	Figge et al.
6,279,449 B1	8/2001	Ladika et al.
6,412,391 B1	7/2002	Stevens et al.
6,595,102 B2	7/2003	Stevens et al.
6,653,972 B1	11/2003	Krikorian et al.
6,782,790 B2*	8/2004	Barrett

(Continued)

FOREIGN PATENT DOCUMENTS

(21) Appl. No.: **13/483,995**

WO	97/16697	5/1997
WO	2011/148165	12/2011

(22) Filed: **May 30, 2012**

OTHER PUBLICATIONS

(51) **Int. Cl.**
F42D 5/045 (2006.01)
F41H 5/007 (2006.01)

“Review of methods to attenuate Shock/Blast waves,” Igra et al, Dec.
2012.*

(52) **U.S. Cl.**
USPC **219/383**; 219/201; 219/202; 89/36.01;
89/36.07; 89/36.08; 89/36.09

Primary Examiner — Joseph M Pelham

(74) *Attorney, Agent, or Firm* — Thompson Hine LLP

(58) **Field of Classification Search**
None
See application file for complete search history.

(57) **ABSTRACT**

A method and system for attenuating a shockwave propagating through a first medium by heating a selected region of the first fluid medium rapidly to create a second, transient medium that intercepts the shockwave and attenuates its energy density before it reaches a protected asset. The second medium may attenuate the shockwave by one or more of reflection, refraction, dispersion, absorption and momentum transfer. The method and system may include a sensor for detecting a shockwave-producing event, determining a direction and distance of the shockwave relative to a defended target and calculating a firing plan, and an arc generator for creating the second medium. The arc generator may create the second medium by creating an electric arc that travels along an electrically conductive path utilizing at least one of high intensity laser pulses, pellets forming a conductive ion trail, sacrificial conductors, projectiles trailing electrical wires, and magnetic induction.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,195,042 A	8/1916	Leon
2,405,694 A	8/1946	Nicolas
2,513,279 A	7/1950	Albert
3,050,707 A	8/1962	Baker et al.
3,660,951 A	5/1972	Cadwell
3,773,168 A	11/1973	Meinass
3,875,844 A	4/1975	Hicks
3,943,870 A	3/1976	Paslay
4,215,630 A	8/1980	Hagelberg et al.
4,313,181 A	1/1982	Holm
4,543,872 A	10/1985	Graham et al.
5,020,411 A *	6/1991	Rowan
H1231 H	9/1993	Richards
5,341,718 A	8/1994	Woodall et al.
5,394,786 A	3/1995	Gettle et al.

23 Claims, 7 Drawing Sheets

